

## CLAIMS

[1] A multimode optical transmission system for converting inputted electrical signals into optical signals, and performing multimode optical transmissions of the optical signals, the multimode optical transmission system comprising:

a plurality of light sources for respectively converting the electrical signals into a plurality of optical signals respectively having different wavelengths, and respectively outputting the plurality of optical signals;

a wavelength multiplexing section for performing wavelength multiplexing of the plurality of optical signals outputted from the plurality of light sources, and outputting a resultant signal as a wavelength multiplexed signal;

a multimode optical transmission path for optically transmitting in multimode the wavelength multiplexed signal outputted from the wavelength multiplexing section;

a plurality of optical signal extraction sections for respectively extracting, from the wavelength multiplexed signal transmitted on the multimode optical transmission path, optical signals each having a mode having a particular wavelength and a particular propagation constant; and

a plurality of optical receiving sections for respectively receiving the optical signals extracted by the plurality of optical signal extraction sections, and respectively converting the received optical signals into electrical signals;

wherein

the wavelengths of the plurality of optical signals  
outputted from the plurality of light sources are set, such that  
a propagation constant of a fundamental mode of an optical signal  
5 outputted from each light source and a propagation constant of  
a high order mode of an optical signal outputted from any other  
light source are different from each other.

[2] The multimode optical transmission system according to  
10 claim 1, wherein

the plurality of optical signal extraction sections each  
include

an optical reflection section for reflecting a  
corresponding one of the optical signals each having the mode having  
15 the particular wavelength and the particular propagation constant,  
and

a reflected optical signal extraction section for  
extracting the optical signal reflected by the optical reflection  
section.

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[3] The multimode optical transmission system according to  
claim 1, wherein

the plurality of optical signal extraction sections each  
include

25 a plurality of optical reflection sections for

respectively reflecting optical signals each having a mode having a particular wavelength and a particular propagation constant,

a plurality of reflected optical signal extraction sections for respectively extracting the optical signals reflected  
5 by the plurality of optical reflection sections,

a plurality of optical delay sections for respectively adding appropriate delays to the optical signals extracted by the plurality of reflected optical signal extraction sections, and

a multiplexing section for multiplexing the optical  
10 signals respectively outputted via the plurality of optical delay sections.

[4] The multimode optical transmission system according to claim 1, wherein the plurality of optical signal extraction  
15 sections each are an optical filter for transmitting a corresponding one of the optical signals each having the mode having the particular wavelength and the particular propagation constant, and reflecting any other optical signals.

20 [5] The multimode optical transmission system according to claim 1, wherein

the plurality of optical signal extraction sections each include

a plurality of optical filters for respectively  
25 transmitting optical signals each having a mode having a particular

wavelength and a particular propagation constant, and reflecting any other optical signals,

a plurality of optical delay sections for respectively adding appropriate delays to the optical signals transmitted  
5 through the plurality of optical filters, and

a multiplexing section for multiplexing the optical signals respectively outputted via the plurality of optical delay sections.

10 [6] The multimode optical transmission system according to claim 1, 2 or 3, wherein

the multimode optical transmission path is a multimode optical fiber.

15 [7] The multimode optical transmission system according to claim 1, 2 or 3, wherein

the multimode optical transmission path is a single mode optical fiber, and

a wavelength of an optical signal propagating through  
20 the single mode optical fiber is smaller than a cutoff frequency of the single mode optical fiber.

[8] The multimode optical transmission system according to claim 1, 2 and 3, wherein

25 the multimode optical transmission path is a free space

having a plurality of transmission paths.

[9] The multimode optical transmission system according to claim 2 or 3, wherein

5 the optical reflection section is a Fiber Bragg Grating.

[10] The multimode optical transmission system according to claim 2 or 3, wherein the optical reflection section is an optical filter for transmitting a corresponding one of the optical signals  
10 each having the mode having the particular wavelength and the particular propagation constant, and reflecting any other optical signals.

[11] The multimode optical transmission system according to claim 2 or 3, wherein the reflected optical signal extraction  
15 section is an optical circulator.

[12] The multimode optical transmission system according to claim 2 or 3, wherein the reflected optical signal extraction  
20 section is a photocoupler.

[13] The multimode optical transmission system according to claim 3, wherein the plurality of optical delay sections each are optical waveguide.

[14] The multimode optical transmission system according to claim 3, wherein the plurality of optical delay sections each adjust a delay amount by changing a refractive index of an optical transmission path.

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[15] A multimode optical transmission method for converting inputted electrical signals into optical signals, and performing multimode optical transmissions of the optical signals, the multimode optical transmission method comprising:

10 a light outputting step of, by using a plurality of light sources, converting the electrical signals into a plurality of optical signals respectively having different wavelengths, and outputting the plurality of optical signals;

a wavelength multiplexing step of performing wavelength  
15 multiplexing of the plurality of optical signals outputted at the light outputting step, and outputting a resultant signal as a wavelength multiplexed signal;

an optical transmission step of, via a multimode optical transmission path, optically transmitting in multimode the  
20 wavelength multiplexed signal outputted at the wavelength multiplexing step;

an optical signal extracting step of extracting, from the wavelength multiplexed signal transmitted via the multimode optical transmission path, a plurality of optical signals each  
25 having a plurality of modes each having a particular wavelength

and a particular propagation constant; and

a light receiving step of receiving the plurality of optical signals extracted at the optical signal extracting step, and converting the received optical signals into a plurality of electrical signals, wherein

the wavelengths of the optical signals outputted at the light outputting step are set, such that a propagation constant of a fundamental mode of an optical signal outputted from each light source and a propagation constant of a high order mode of an optical signal outputted from any other light source are different from each other.